to San Francisco. After graduation in medicine he took up the active practice of that profession, and continued in it up to the date of his death, which occurred May 28th, 1901, at the early age of 32 years. He was married and leaves a widow and two children.

He was an active member of several medical and dental societies, and wrote a number of able papers. He was an expert microscopist and bacteriologist, and had a promising career before him. We mourn his early death, before his life's work was accomplished.

SYMPOSIUM ON PURE MILK SUPPLY.

THE NECESSITY OF A PURE MILK SUPPLY FOR INFANT FEEDING.*

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IF EVERY infant were permitted the privilege of deriving its nourishment from the breast of a healthy mother, a paper with the above-named title would be unnecessary, it being universally conceded that breast milk is the ideal infant food and that no substitute can satisfactorily take its place. I desire to postulate that we have in uncooked, fresh, clean, uniformly stable milk, from a healthy herd of cows kept under sanitary conditions, when properly modified, the best substitute. That the production of such a milk is possible has been abundantly proved by the work that has been done in this direction in eastern cities, where the medical profession has considered the subject of sufficient interest in which to bestir itself.

It is undesirable to take the time of this body in discussing the myriads of infant foods placed upon the market by their respective enterprising manufacturers, for it is my conviction that they are all more or less harmful, but from the evidence of the enormous consumption of these nostrums, it is patent that too large a proportion of the profession derive their light in infant feeding from that omnipresent font of learning, the obsequious but tenacious representative of the baby-food manufacturer. Lest this statement may appear pedantic I wish to state that these preparations containing, as they do, a minimum amount of fat and an excessive amount of carbohydrates, many of them insoluble carbohydrates, are the principal etiologic factors in the production of rickets and other conditions of malnutrition. If this be true, then emphasis is given my statement regarding the desirability of cow's milk produced under the ideal conditions mentioned above, which I here desire to elaborate.

I have said that this substitute is to be found in a raw, fresh, clean cow's milk, unvarying in the proportion of its nutritive constituents, and obtained from a healthy herd.

1. The necessity of raw milk. Milk sterilized by heating to 212° F. is rendered difficult of digestion by reason of the fact that the casein is rendered less coagulable by rennet, and appears to be acted upon more slowly by pepsin and trypsin; a change takes place in the lactose, changing it into caramel; certain changes occur in the fat; certain natural ferments in fresh milk, believed to be of value in digestion, are destroyed, and some of the lime salts that are usually soluble, are converted into insoluble compounds. That such milk is productive of scurvy was shown by the American Pediatric Society's report in 1898, where of three hundred and seventy-nine (379) cases of scurvy in infants, one hundred and seven (107) of them had been on a diet of sterilized milk. While it is true that such sterilization destroys pathogenic bacteria, spores are not destroyed, and spore-bearing bacteria will develop in such milk at ordinary temperatures. As some of these bacteria act only on the proteids, the milk may not sour, and so its condition may not be recognized. Vaughn has shown that some of the toxins generated before milk undergoes lactic acid fermentation, are deadly, even in small quantities, and are not rendered innocuous even by intense degrees of heat.

The pasteurization of milk at from 140° to 157° F. does not present the objectionable features of sterilized milk to the same degree. The difficulties in the way of perfect technic in the average home, however, are such as to make proper pasteurization impracticable and well-nigh impossible. Tubercle bacilli have been known to live after an hour's exposure to a temperature of 149° F. The effect of pasteurization on caseinogen is at present questionable. Lactalbumen, the chief principle of the split-proteids, or whey proteids, coagulates at a temperature of 161.6°. To quote again from the American Pedriatic Society's report of 1898, twenty (20) of the three hundred and seventy-nine (379) cases of scurvy were fed on pasteurized milk. Sill reports one hundred and seventy-nine (179) babies fed on pasteurized milk, where 97 per cent showed signs of rickets and scurvy. These babies were in institutes where modification of the milk was properly carried out. Statistics multiply, but enough has been said to demonstrate the fact that the digestibility of cooked milk is questionable. Certainly, if clean milk can be obtained, the necessity of cooking it disappears.

2. The necessity of fresh food for infant feeding is beyond peradventure, and needs no more

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elaboration here. One who has had any experience in infant feeding sees daily illustrations of the evidences of malnutrition and deformity as the result of prepared infant foods and condensed milk. The clinics in all our large cities abound with these little sufferers, made so by the commercial instincts of the food manufacturers, and too often by the laziness and ignorance of the physicians who prescribe them. These cases make a truly pathetic picture, and present a most eloquent and touching appeal for an amelioration of the causes which make such conditions possible.

3. To obtain a clean milk, unvarying in its nutritive constituents, is a matter of vital importance in the successful feeding of these little patients. The difficulties in the way of accomplishing this are, however, great, because cows are frequently unhealthy; they are dirty; milkmen are dirty; stables are filthy; dairies are unsanitary; the water supply is frequently polluted; cows are improperly fed; milk is not properly and promptly cooled and kept cold until delivered. Because of such conditions epidemics of infectious diseases are of frequent occurrence. Kober reports three hundred and thirty (330) outbreaks of infectious diseases spread through the milk supply. Estes examined one hundred and eighty-six (186) specimens of milk coming from all parts of England. The bacillus tuberculosis was present in eleven (11) cases. Pus was present in forty-seven (47) cases, muco-pus in seventy-seven (77) others; blood was present in twenty-four (24) specimens; streptococci in 75 per cent of all the cases. Eighty per cent of all the samples contained pus, muco-pus, or streptococci, and were unfit for use. Reed of Cornell, and Ward of the University of California, in considering the significance of the presence of streptococci in market milk, draw attention to the prevalence of mammitis in cows as constituting an important source of this infection. The insidious onset of this disease is responsible to some degree for the marketing of infected milk by dealers with innocent intentions. That such milk is responsible for a large proportion of the cases of infantile diarrhea there can be no doubt.

Believing that a number of cases of gastro-enteritis occurring among infants in my private practice, who were fed exclusively on modified cow's milk, were due to infected milk, I collected last winter a number of specimens of milk from different sources of supply in San Francisco, and submitted them to bacteriologic and chemical examination. The bacterial counts were made by Dr. H. A. L. Ryfkogel and the chemical examinations by Mr. Frank T. Green, chemist for the San Francisco Board of Health. The specimens were taken during cold weather when the bacterial count would naturally be low. They were received in sterile vessels, immediately placed on ice and so kept until examined. The lowest bacterial count was 14,400 per cubic centimeter, the highest 1,500,000, with an average of 223,800. The highest count was from a specimen purchased from a corner bakery, such depots, by the way, being very popular for securing an extra supply of milk when the regular supply for the baby runs short. It was learned on inquiry that this supply came from San Joaquin and Contra Costa Counties, and was brought to the city by boat, once in twenty-four (24) hours. It is not intended to infer from a report of these counts that they are conclusive estimates of the cleanliness of the dairies represented by them. Such would manifestly be unfair, because so many conditions, some of them temporary, influence the number of bacteria found in a given number of specimens submitted for examination. I believe, however, I make a consistent statement when I say that an average of 223,000 bacteria per cubic centimeter, taken from a number of specimens collected at random from our largest and most reputable dealers, calls for serious consideration as to the causes of such pollution. An explanation is easily forthcoming when we consider the condition of the farms as found when I visited a number of them. The stables, with one exception, were foul, ill-ventilated, dark and ill-smelling, with lofts overhead for the storage of feed. No attempt was made to groom cows or clean udders. No pretense at cleanliness among the milkmen was observed. No medical supervision over the workers was observed, nor was there any veterinarian inspection of the herds. Drainage was, as a rule, bad. In one instance the entire drainage from barns, houses, privies, etc., was received in a ditch which flowed by an unprotected well, from which the entire water supply was obtained. In another it flowed through the pasture and was accessible to the cows. In only one was the manure carted away regularly. In one it was simply dumped on a pile just outside the barns, where it lay for a year before being removed. These dairymen are not deliberately and maliciously polluting their milk. They are anxious to give a pure product, and the pathetic part of it is that they believe that they are. They are uneducated regarding the production of milk under sanitary conditions. In all of the farms that I visited some attempt was made to sterilize pails and cans, either by ordinary washing or washing and dipping into boiling water. These pails are then handled by dirty milkmen, left standing a varying length of time in the stables exposed to all the filth with which they inevitably come in contact.

Some plan of aerating and cooling the milk is adopted by all of them, usually by means of letting it flow over zinc tubes, through which water at ordinary temperature is forced. This of course, cools it to from 60° to 70,° a temperature en-

tirely insufficient for the inhibition of bacterial growth. In some instances the cooling process consists in merely plunging the cans into a vat of cold water. None of these dairies bottle milk at the farms. Some of them do so at their supply depots in the city to satisfy a small demand for bottled milk, where a few have fairly well-equipped apparatus for aerating and cooling their already infected milk. Butter fat varied in the specimens examined from 3.2 per cent to 8.7 per cent, a sufficient variation to make a proper modification impossible. The majority of them exceeded 4 per cent. A few of them bore evidence of being watered. One yielding only 3.2 per cent fat, had a specific gravity of 1,029 and a total solid percentage of only 11.38 per cent. This specimen gave a bacterial count of 255,000, and was procured from one of our most reputable dealers. No examination for chemicals was made. It is not intended in this paper to enter into a consideration of the prevalence of the use of chemicals, or their effects on digestion. The San Francisco Board of Health has had considerable trouble with dairymen over this question, but it is strange that the condition which made the addition of chemicals necessary has heretofore received no consideration.

Such, in brief, are the conditions surrounding the production of this food product for the San Francisco market, and the presence of such conditions have made the sterilization of milk necessary.

The greatest step in advance in recent years, however, in the successful feeding of infants has been the demonstration of the fact that a practically pure, sterile milk can be obtained, and thus do away with sterilization. To Dr. Henry L. Coit of Newark, N. J., belongs the credit of having demonstrated the fact to the American profession that pure so-called "certified milk" can now be obtained by instituting proper hygienic precautions regulating the production and care of the milk. Several Eastern cities have established Milk Commissions by their county medical societies, and have successfully solved this problem. The plan of procedure is similar in all of them, and for purposes of illustration I abstract a recent report of the Commission of the Philadelphia Pediatric Society. The Commission, consisting of five members, holds itself in readiness to examine milk from dairies desiring this examination, and to certify to the good quality of milk which comes up to the standards fixed by it. The Commission selects a bacteriologist, a chemist and a veterinary inspector. The bacteriologist procures a specimen of milk without previous notice to the dairy, which he tests for the number and nature of the bacteria present in it. He also makes a microscopic examination for pus cells. This examination must be made at least monthly. Milk free from pus and injurious germs, and having not more than 10,000 germs of any kind or kinds to the cubic centimeter, is considered up to the required standard of purity.

The chemist procures and examines the milk for the percentages of fat and total solids, and for the specific gravity. He also tests its chemical reaction, and examines it for the presence of foreign matters, or of chemicals added as preservatives. Standard milk shall range from 1.029 to 1.034 specific gravity, be neutral or very faintly acid in reaction, contain not less than from 4.5 per cent to 5 per cent fat, and shall be free from all contaminating matter and from all addition of chemical substances or coloring matter. Richness of cream in fat shall be specified and shall not vary more than 1 per cent above or below the figure named in selling.

The veterinary inspector at regular intervals and without previous warning inspects the cleanliness of the dairy in general, the care and cleanliness observed in milking, the care of the various utensils employed, the nature and quality of the food used, and all other matters of a hygienic nature bearing upon the health of the cows and the cleanliness of the milk, including also as far as possible, the inquiry into the health of the employees on their farms. He also sees that the cows are free from tuberculosis or other diseases. The fees of the experts are paid by the dairymen at the time of the examination. Any dairy, the milk of which shall be found to be up to the required standard shall receive a certificate from the Commission. Milk furnished by the dealers to whom certificates have been issued shall be furnished to consumers in glass bottles hermetically sealed in a manner satisfactory to the Commission. In addition to the sealing and as a guarantee to the consumer that the examination has been regularly conducted, there shall be pasted over the mouth of the jar, or handed to the consumer with every jar, a copy of the certificate issued with the date thereof. Four producers have met the requirements of this Commission, and the work of the experts since the first appointment of the Commission in December 1898 has been most satisfactory. The attempt to keep the fat content near the required standard has been eminently successful, the widest variation being 7 per cent.

This has been a great drawback in the proper feeding of infants in San Francisco, the fat in the specimens collected by me varying from 3.2 per cent to 8.7 per cent. The reason of this is because no attention is given to the scientific feeding of the herds; every dairyman having his own ideas, but none of them, as far as I could learn, endeavoring to observe any ratio between the proteids and the carbohydrates and fats.

Of the dairies holding certificates from the Philadelphia Commission probably the best equipped one is the Walker-Gordon farm, situated at

Plainsboro, N. J., which I had the pleasure of inspecting about a year ago. The barns are constructed with perfect ventilation and with absolutely water-proof floors. They have neither cellars nor lofts. They are fitted with trolleys for the conveyance of feed and manure, and are furnished with water and live steam for cleansing purposes. The cows are carefully selected American grades. They have passed the tuberculin test for tuberculosis, and they have been quarantined for the possibility of other diseases. They are under the immediate care of a competent foreman and have the periodical attention of an expert veterinarian. The water used for washing, rinsing, watering cows, and for all other purposes, is drawn from a protected well. This well is isolated from buildings, and is more than one thousand feet from the farmhouse. It is forty feet deep. The well is curbed and lined with brick set in Portland cement, to the bottom; it is protected from surface seepage with an extra wall on the outside for seven feet in depth, and is cemented inside to the water line. It is fenced in with a high fence for fifteen feet on every side; it is inaccessible to animals and to all the employes, except the superintendent. All the buildings used for milk production and care are carefully drained by means of glazed earthenware, tight tile pipes, trapped and ventilated. The cows are maintained in health; they eat the best food and drink pure water. Their food is selected for them and fed to them with scientific care. They are not pastured at any time. The water is brought in pipes and drank from vessels, sterilized whenever occasion requires. The cows are kept clean. They have abundance of air, exercise and sunshine. A local physician, approved by the Commission, has supervision of the health of the men that are employed on the farm and of the help in the boarding house. Slight sickness among the help receives instant examination by the physician, who is responsible to the Commission. Before and during the process of milking, the attendants are required to wash thoroughly in the presence of the superintendent. They wear white clothing, which is sterilized freshly before each milking with moist steam in sterilizers used only for this purpose. The superintendent also supervises all process of milking, and guards against any contamination of the milk by the attendants. The milk is taken from the barn to the milk-house as soon as it is milked. It runs into a porcelain receiving tank and from this through a filter, into a mixing tank and over a specially constructed cooler that reduces it to a very low temperature. The whole time occupied in the process is not more than five minutes for any given body of milk. The exposure of the milk in the milk-house is reduced to the smallest possible time compatible with mixing, cooling and bottling. The air of the milk-house is clean, and is changed by an exhaust process, new air being admitted after it is filtered and washed by a spray. Special precautions are taken to exclude flies. The walls and floors of the house are water-proof. The dairymen wear specially sterilized clothing. They do not visit the barns or do work upon the farm. The milk-house is fitted with two large sterilizers. All packages received from without are sterilized before being washed, and again after rinsing and before filling. All cans, tanks, coolers, separators, milk-pails, milk-stools, shipping cases and other articles or appliances which come in contact with the milk, are previously sterilized. The jars and bottles, with their covers, are sterilized before use. The time allowed for transportation from the farm to the laboratory is less than two hours. The superintendent is a man who has been trained for this work, and has special qualifications for his position. He supervises all operations in the barns and milk-house, carries out all the rules laid down by the experts employed by the Commission and, besides, makes daily examinations of the chemical and bacteriological condition of the milk.

These are ideal conditions, and are necessarily productive of high-priced milk. Milk from this farm sells in New York City at 15 cents per quart.

The public needs a great deal of education on this subject. They demand good milk and they demand cheap milk. They know nothing of the germs in the milk that they neither see nor taste, and when their babies become infected, dentition is usually considered the etiologic factor and the attending physician is oftentimes responsible for this, for the gum lancet has not yet entirely had its day as a therapeutic measure in infantile convulsions. The duty of the medical attendant is, however, manifest. His patients should be instructed that cheap milk is not good milk, that sweet milk which contains an abundance of cream is not necessarily clean milk. The average layman does not to-day object to the use of diphtheritic anti-toxin because of its price, when he recognizes in it a life-saving measure; nor will he object to the cost of pure milk for feeding his infant when he is educated by the medical profession to the fact that it also is a life-saving measure. The demand for a high-priced milk must, however, be a limited one in any community, and with a large proportion of the people it will have to be used as a medicine rather than as a food for general household consumption.

This work must be taken up by the medical profession, and preferably, through the agency of the county medical society in the community. Milk Commissions should be established in all cities. The better class dairymen (and by these I mean those dealers who have control over their own farms, not those who act merely as middlemen) should be invited to co-operate. A small

proportion of them will be able to bring their milk up to the required standard, and the profession must encourage the successful ones by doing everything in their power to inform the public that pure milk is worth more than unclean milk. This will be difficult at a time like the present, when the tendency with this industry, like most others, is toward large syndicates assuming the control of the enterprise. Under such conditions it will be impossible to attain supervision over the quality of the supply. The dairyman will naturally be slow to co-operate and assume the additional expense necessary, unless he can be assured of the existence of the demand. The responsibility, therefore, clearly rests with the medical profession, for to them, and to them only, must we look for the education of the public in this matter.

CONCLUSIONS.

1. Uncooked milk is necessary for the successful artificial feeding of infants.
2. Uncooked milk, to be a harmless food, must be clean and free from pathogenic bacteria and chemicals.
3. Such milk can be obtained only by medical supervision over the details of production, together with regular veterinarian inspection of the herds.
4. Such inspection can be most successfully accomplished under the auspices of the county medical society in the community.
5. The demand for such milk must be accomplished by the instruction of the public by the medical profession.

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DISEASES OF INFANCY DUE TO FAULTY NUTRITION.*

INFANTILE RHACHITIS, INFANTILE SCORBUTUS AND INFANTILE ATROPHY.

By WILLIAM NORBERT SULLIVAN, M. D., San Francisco.

THE symposium of which this paper is a part has for its object the consideration of the nutrition of the infant. The subjects of proper milk supply and milk modification have received attention. It remains for me to present the result of a study of the diseases of infancy which are associated with faulty nutrition.

If we investigate the etiology of rhachitis we find that a variety of causes are described and furthermore, that we may almost take our choice for, as Strumpell says, "Although the clinical and anatomical phenomena of rhachitis have been often and accurately investigated, the true cause of the disease still remains entirely unknown." He speaks of the lactic acid theory and of the influence of phosphorus and lime. He refers to Oppenheimer's malarial theory and to the theory of heredity, the proof of which latter, he says, is lacking. Osler refers to the geographical and racial conditions operative in the causation. In Vienna and London, he says that 50 to 80 per cent of the children presenting at clinics are rhachitic. A starchy diet, too much cow's milk, and indiscriminate feeding; but, he continues, something more is required beyond these, for the children of healthy parents who have ample quantity of proper food may become rhachitic. He says that there is no evidence that the disease is hereditary, but there is probably a fetal form.

As the real issue of this paper is to show the relation of improper feeding to the diseases considered, I have stepped aside from the multiplicity of theories and searched for support of the view which maintains that improper feeding is the chief etiologic factor in the production of rickets, scurvy and marasmus.

Dr. Charles O'Donovan, in giving a representation of the relation which food maintains to the production of rickets, cites a case which is illustrative of the manner in which a great many rhachitic subjects are fed in infancy. He says: "The mothers are impressed with the idea that the food for the child must be 'strong' and consequently give the child anything but milk, just as soon as this is possible, and have as a result gastro-intestinal irritations, and in the majority of cases rickets." One child was brought to him 14 months old, weighing 9 pounds. It was rhachitic, extremely feeble and undeveloped, without teeth. Yet the child had been born healthy and had grown as long as the mother had nursed it, and not until it was given all sorts of food did it become rhachitic. At about five months it began to eat potatoes and cabbage, and any other vegetable or meat that happened to be on the table and soon, much to the surprise of the family, it began to show signs of distress. "Teething" was accused of the trouble and it had been "teething" ever since without the development of a single tooth. When the woman was asked if she gave the child milk she said that milk always disagreed with it and was refused. This was not so, for when the child was taken to the hospital and placed on a milk diet it improved forthwith.

In reviewing the papers presented in the last twenty years on the relation of improper feeding to the production of rickets, we cannot help but note that the element of fat seems to bear a relation to the causation of the disease. It is claimed that rhachitis does not exist in Japan and the explanation advanced as to the reason of this is, that the Japanese have always eaten plentifully of the fats and oils of fishes, the blubber of

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